12 October 1964

Dear Joe:

Subject: EG-400 - Final Report - Bidirectional Printer (Belair)

Enclosed herewith is one (1) copy of the subject report.

Dick

RRW:eb
In Duplicate
Enclosure (1) Copy #25

cc: AL w/enc.(Copies 1 & 2)
RK w/enc. (Copy 3)
AH w/enc. (Copy 4)
HZO w/enc. (Copy 5)

FINAL REPORT

Bidirectional Printer
(Belair)

30 September 1964

Prepared by:

25X1A

[redacted]

25X1A

Approved by:

[redacted]

Contract EG-400

Copy 25 of 25

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

SUMMARY

The Belair Printer resulted from a desire to simplify continuous printing for the following operational modes:

1. Printing of discrete short sections within a roll of negative material.
2. Reprinting of frame(s) or section(s) of a negative roll.
3. Bidirectional printing.

In general the problem was mechanical in nature, in that a suitable arrangement of standard printer (Niagara) parts was made to allow separation of the negative and printing materials to provide complete freedom of negative positioning.

This conversion was accomplished primarily by the design of a lamp house which could be moved to either separate the negative and printing stock for negative slewing, or position the negative and printing material for printing.

Testing has proven that the Belair Printer incorporates all of the high quality features of the best available contact printers and simplifies the three operational modes (1, 2, and 3) noted above.

EG-400

30 Sept 64

SUBJECT: Belair Printer (Bidirectional Reprint Printer)

TASK/PROBLEM

1. Design and test a bidirectional reprint printer which will provide a convenient mechanism to allow reprinting of short lengths within a given length of original material. Rapid safe slewing of negative materials without unthreading is to be a design goal.

INTRODUCTION

2. The design of the Belair Printer (see Figure 1) was initiated to simplify standard continuous printers in several modes in addition to continuously printing a complete negative roll. Specifically, the operations to be simplified were:

a. Printing of discrete short sections within a negative roll.

b. Reprinting of frame(s) or section(s) of a negative roll.

c. Bidirectional printing.

3. Design effort for the above three objectives was approached with the following considerations:

a. Do not degrade output quality of existing continuous printers.

b. Maintain or improve the production capabilities of existing continuous printers.

c. Achieve flexibility and simplicity in the resulting design.

DISCUSSION

4. General Approach: To minimize the design effort and maintain all high-quality features of existing continuous printers, the Niagara Printer was modified where necessary to achieve the desired end results. The reprint and selective print features were incorporated by providing the capability of

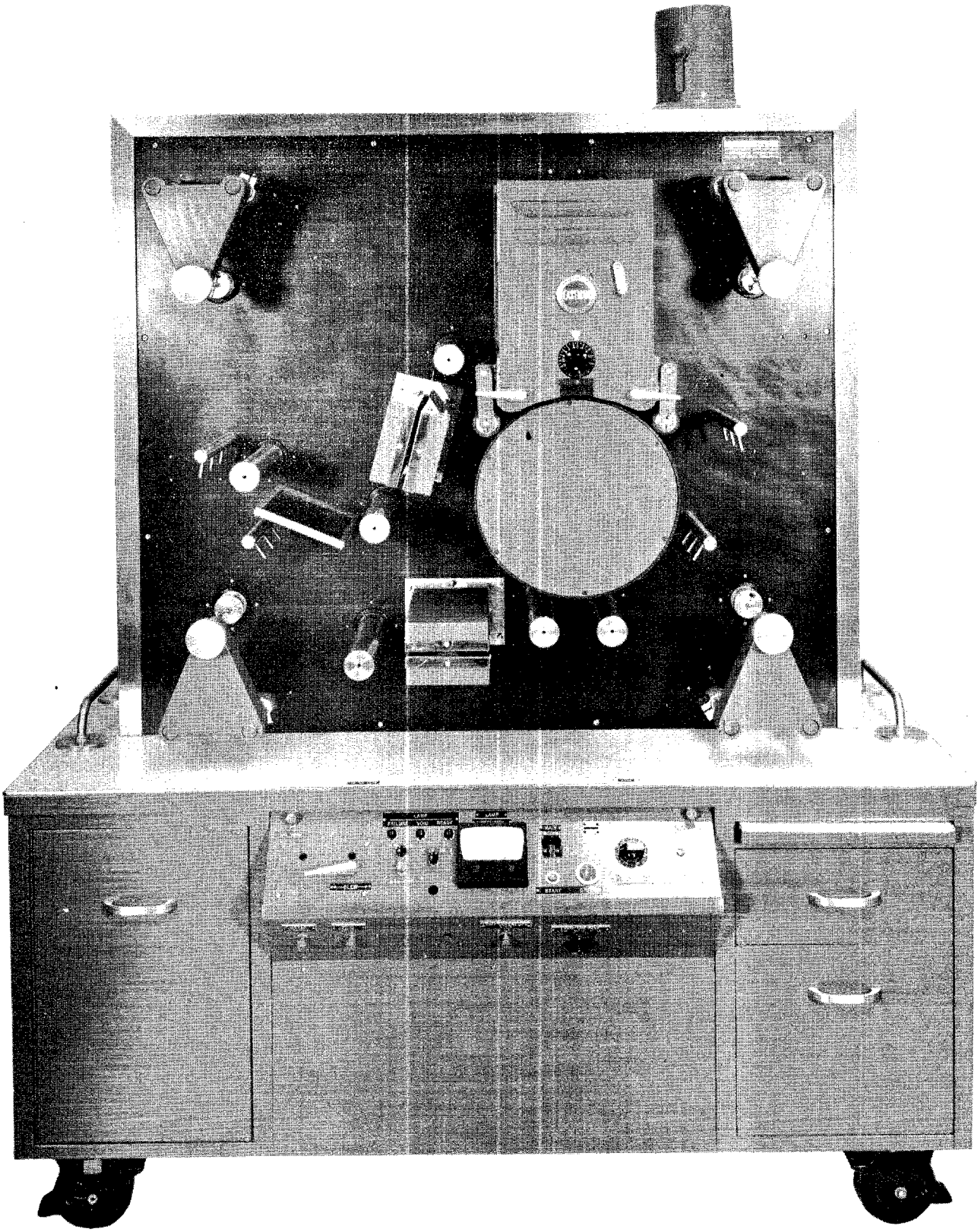

Figure 1. Over-all View of the Bidirectional Printer (Belair)

selectively moving (slewing) the negative material in respect to the print material. Since the print material must remain stationary during the search or repeat motion of the negative material, separation of the two materials was essential during this operational mode. After a particular section of negative material has been positioned, the negative and print material must be brought into intimate contact for printing. To achieve separation and repositioning of the negative material, it was decided to move the Niagara lamp house vertically. This scheme has the advantage of not effecting the basic film handling components, and therefore, not affecting film tracking.

5. Lamp House Design Features: Components modified or added to the Niagara Printer to achieve the bidirectional and reprint capabilities are:

a. Lamp House: The lamp house is larger than its Niagara Printer counterpart and has the capability of a 3-inch vertical movement to provide a film path for negative slewing. Figure 2 shows the lamp house seated in its printing position and Figure 3 shows it raised for negative slewing. The lamp house is guided in its travel to remove side motion and to maintain alignment for the rollers attached to the lamp house to insure accurate tracking in both the printing and slewing positions. Guiding is achieved by the use of guide blocks and adjustable screws with nylon tips. Hardened pins furnish accurate locating when the lamp house is seated in the printing position. An air cylinder which provides vertical motion is connected directly to the lamp house and, operating from a 30 to 35 psi air supply, provides rapid (less than two seconds) and smooth motion from the printing to slewing (or slewing to printing) position. A solenoid-operated four-way Versa valve is used to control the air cylinder.

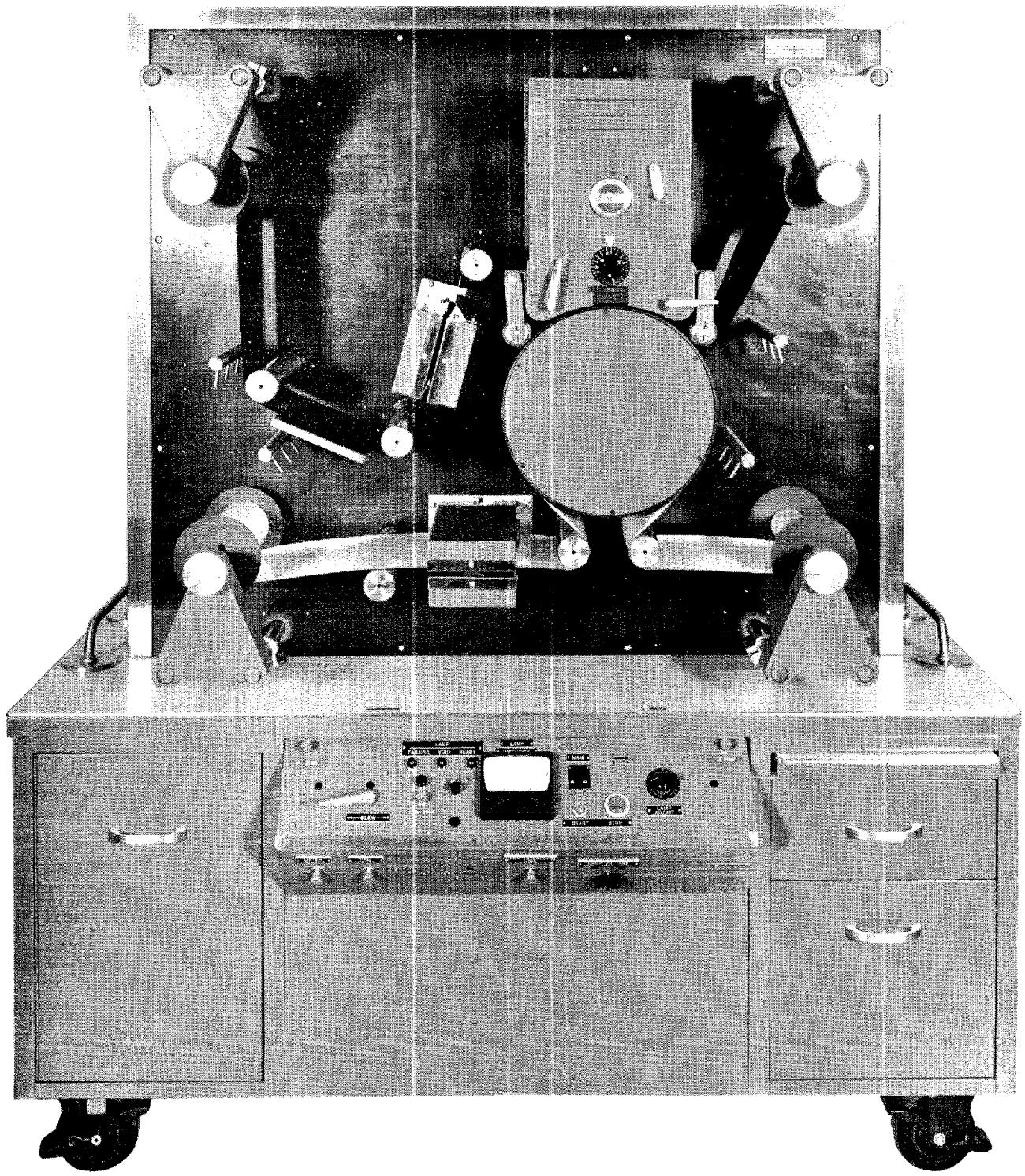

Figure 2. Lamp House Seated for Printing

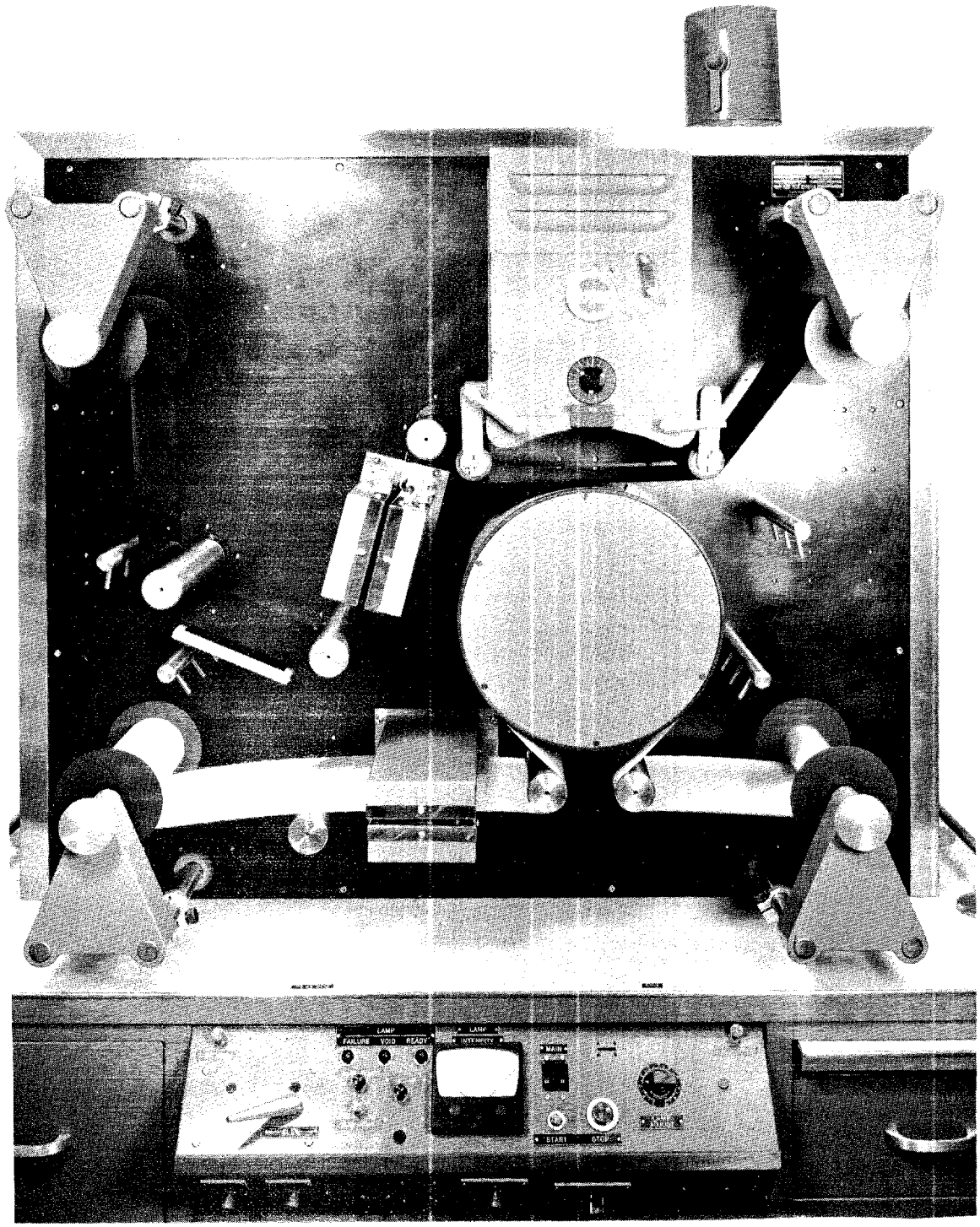

Figure 3. Lamp House Raised for Negative Slewing

b. Wedge Assembly: To control light intensity, a variable neutral density filter or wedge is placed into the light path emanating from the printing lamp. The desired intensity is selected by rotating a calibrated knob located on front of the lamp house. This knob is calibrated from 0 to 1.0 in increments of 0.1. The wedge always remains in the light path, and, when 0 density is required, the 1 1/8-inch clear area along the leading edge is used. Because of this feature, there is no transition between the conditions of no filter and filter in the light path, and this advantage results in a cleaner optical transition than that on the Niagara Printer. Also, the quality of the leading edge of the optical density wedge (a costly requirement in the Niagara) is unimportant since it is never introduced into the light path.

c. Light Source: A single General Electric H-100 H4/T mercury lamp is used.

d. Pressure Rollers: Two pressure rollers are used. During the printing phase, one is used as a pressure roller and the other as an idler roller. The control which determines the position of the rollers (pressure or idler) also determines the direction of printing by the use of cam-operated microswitches. Tension springs provide the necessary roller pressure.

e. Lamp House Cooling System: The lamp house is cooled by blowing filtered air into the top section and exhausting it through louvers in the front. This arrangement excludes dust and dirt particles from entering the top of the lamp house within which the lamp, mirrors, filters, solar cells and printing window are located.

6. Film Cleaners: Both the negative and raw stock pass through units containing two inductor bars and two brushes which rotate in a direction opposite to film or raw stock travel. Power for the brushes is supplied by a small Bodine K-2 speed reducer motor. High voltage to the inductor bar is supplied by a Kodak Static Eliminator Power Unit, Model A-2.

7. Viewer: A viewer for negative inspection contains a General Electric Electroluminescent lamp that produces green light. A green filter has been added to further restrict the color of the light. This lamp is being used on a trial basis because of its possible application in radio frequency interference (RFI) programs. Under normal voltage operating conditions, the viewer brightness is inadequate. The shortcomings of the viewer should be overcome on future Bidirectional Printers by using either:

a. An Electroluminescent lamp of increased brightness

b. The Niagara Printer viewer

8. Operating Controls: The top side of the electrical control panel (see Figure 4) contains the following controls:

a. Main Switch, composed of two circuit breakers, 12-amp capacity, which break each side of the line.

b. Lamp intensity meter which indicates the brightness of the lamp and displays any change which takes place.

c. Three pilot lamps which indicate lamp conditions - READY, FAILURE and VOID.

d. START and STOP Buttons.

e. LAMP ADJUST knob which is attached to a variac that controls voltage to the lamp.

f. Two buttons marked LH DOWN which control the down movement of the lamp house. They are spaced on opposite ends of the instrument panel as a safety feature. These pushbuttons are interlocked so that they both have to be pushed and held down at the same time to actuate the circuit.

g. LH UP button which raises the lamp house when pushed.

h. SLEW START and SLEW STOP button which energize their respective circuits when pressed. When the SLEW START button is pressed, the torque motors on the negative have voltage applied to them. This removes any slack which resulted from the shorter negative path when the lamp house was raised.

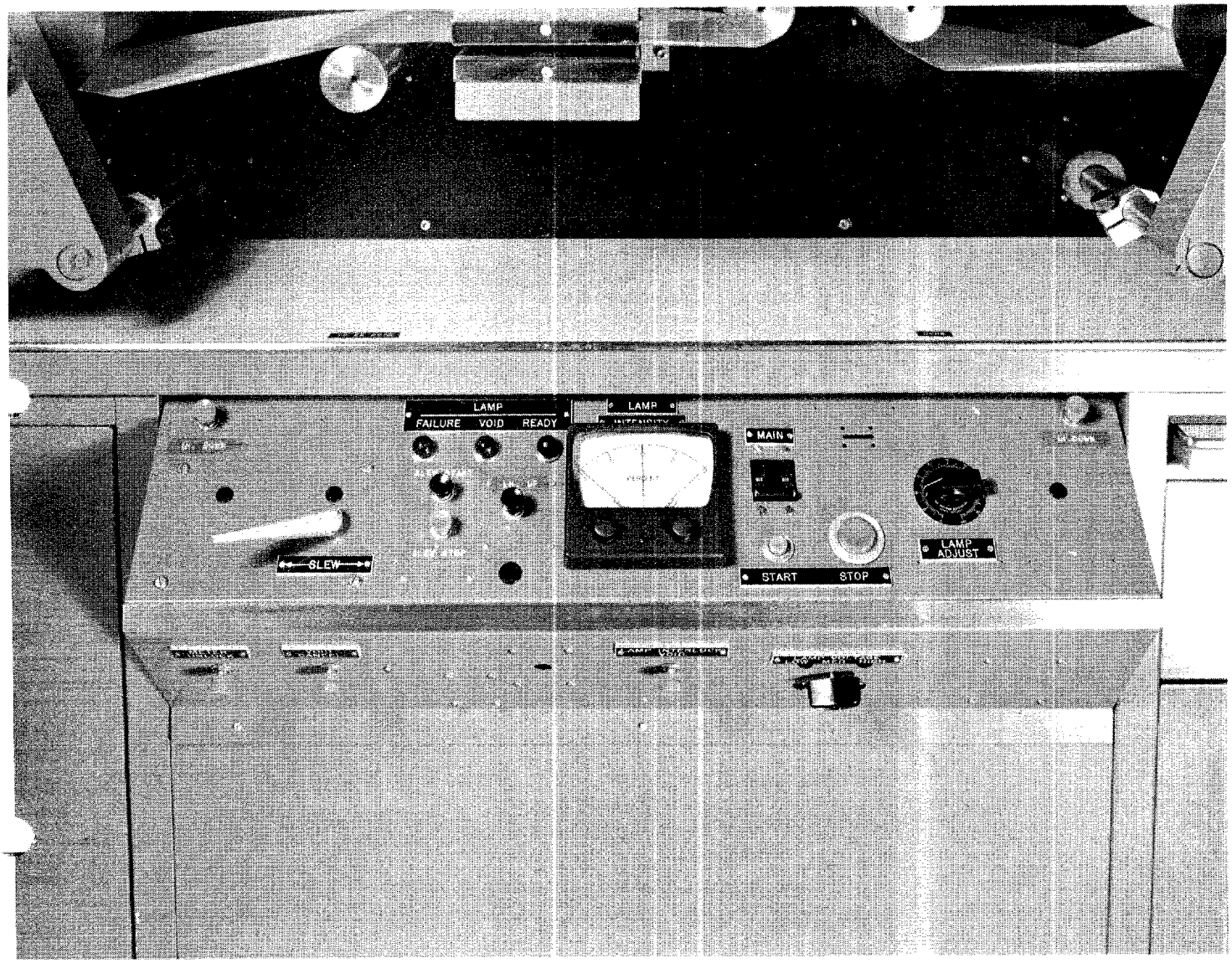

Figure 4. Electrical Control Panel

i. Slew direction and speed control handle -- attached to the common shaft of two auto-transformers, which are ganged. This control provides joy-stick control of direction and speed during negative slewing.

9. Adjustment Controls: The lower side of the control panel (see Figure 4) has the following controls:

a. METER UNLOCK button, which cancels the meter holding relays while depressed. This allows the meter to be reset after it has gone out of tolerance.

b. VOID CANCEL - This button cancels the LAMP INTERLOCK VOID switch and the lamp VOID indication light.

c. LAMP VOLTAGE Switch - a three-position switch to provide low, medium and high voltages to the lamp.

d. The variac controls for the torque motors are located inside the printer. They are preset but can be changed by removing the instrument panel and turning the control knobs.

10. Interlocks:

a. Both rear doors on the cabinet must be closed to operate main power.

b. Pressure rollers must be in up-position before lamp house will either go up or down.

c. Slew stop button has to be pressed before lamp house will come down.

d. The lamp circuit is interlocked to prevent printing when the lamp is not within preset limits.

CONCLUSIONS

11. Based on production printing (approximately 500,000 feet of film), the Belair Printer has provided a simple and efficient means of printing selected short sections, reprinting frames, and bidirectional printing.

12. When not used for the above modes of operation (paragraph 11), the Belair Printer can be used for normal continuous printing.

13. Continuous printing has been simplified due to the bidirectional capability.

14. Film threading is slightly more complicated because of the additional rotating dust and static assembly.

15. The viewer capabilities are substandard due to the inclusion of a luminescent panel used for RFI programs.

RECOMMENDATIONS

16. Because of its versatility, simplicity, and efficiency, the Belair Printer should be considered for field use.

17. Additional effort should be expended to improve the quality of the viewer or the standard Niagara viewer should be used.

REFERENCES

1.	Project Authorization Request, Belair Printer, PAR 17	11 February 63
2.	Interim Report, Bidirectional Reprint Printer, PAR 17	26 May 64
3.	Quarterly Reports, PAR 17, Contract EB-1492	1 July 63 1 October 63 17 January 64 28 June 64